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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A global ozone climatology from ozone soundings via trajectory mapping: a stratospheric perspective" *by* J. Liu et al.

Anonymous Referee #1

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The paper presents a global ozone climatology derived from global ozonesonde data (WOUDC network). 4-day forward and backward trajectories are used to map the ozone measurements from the ozonesonde stations to other locations. This approach is justified by the rather long (compared to the length of the trajectories) lifetime of ozone in the lower stratosphere, which is in the order of weeks to months. The ozone data are provided on a 5° x 5° x 1 km latitude-longitude-altitude grid, covering the domain from the surface up to 26 km. The derived ozone climatology covers the years from 1965 until 2008. The present study evaluates the stratospheric part of the climatology, the tropospheric part is described in a companion paper. A comparison with

a subset of independent ozone soundings and two satellite instruments (SAGE and OSIRIS) shows that the trajectory-based ozone climatology is able to capture the well-known features of stratospheric ozone, like the vertical and latitudinal gradients, the seasonal cycle as well as long-term trends. The ozone climatology can, for example, be used as boundary condition for model simulations or for model validation.

The paper is well written and I think it is worth to be published in ACP. However, there are some open issues that need to be resolved before publication.

- Observational database: The presented ozone climatology is based on ozone soundings only. Due to the limited spatial coverage of the measurement stations this leads to data gaps in the climatology. Would it be possible to use other in-situ data like MOZAIC to fill these gaps?

- In the introduction it is mentioned that there are similar ozone climatologies based on trajectory mapping methods. One plus of the present dataset is certainly the length of the data record. Nevertheless, some more motivation would be desirable. How do trajectory approach and results compare to other studies?

- Sect. 2.1: The ozone stations use different types of ozonesondes, and at some stations there was a change in the sonde type during the long-term ozone record. In those cases, was there any homogenization of the data record? Does a change in the sonde type introduce any bias to the derived ozone climatology?

- P 16839, l 6: Why do you use 4-day trajectories? In Sect. 4.4 it is mentioned that the results improve with 6-day trajectories. How was the "optimal" length of the trajectories determined?

- P 16839, l 14-16: What is the purpose of the two vertical coordinates? Which one is used in the paper?

- P 16849, l 1-2: Which tropopause height is used to separate tropospheric and stratospheric ozone data? The NCEP/NCAR tropopause? How good are tropospause folds

represented?

- Fig. 2: It is hard to identify the differences between the soundings and the trajectories. A plot showing differences between Sonde and Traj might be better, similar to Fig. 4.

- Fig. 4: Wouldn't it be better to show the difference between SAGE and Traj? I guess you want to validate the trajectory-based climatology against SAGE and not the sonde data, right?

- P 16842, l 26: The plots for JJA show the smallest scatter for all three cases. Any idea why this is the case?

- P 16844, l 6: What do you mean by "individual station biases"? Please be a bit more precise.

- Fig. 8 and 9: Why do you use different types of plots to compare the ozone climatology with SAGE and OSIRIS data, respectively?

- Sect. 4.2, Table 4: Do the decadal ozone changes agree with ozone trends derived from other observational datasets? A bit more discussion of the results presented in Sect. 4 would be desirable.

- P 16846, l 21/22: From Fig. 13 I got the impression the latitudinal gradient shows a maximum in winter and a minimum in summer, not in spring and fall, at least on the Northern Hemisphere.

- P 16848, l 7/8: Why do you use 4-day trajectories for the climatology when you get better results with 6-day trajectories?

- P 16850, l 24-26: This statement is true for HALOE, but not necessarily for SAGE-II.

- P 16851, l 1-2: It's hard to say which dataset gives the best results in the troposphere, but from Fig. 16 I would say that SAGE-II shows the best agreement with the ozone sondes, at least in the lower troposphere.

- In general, I would like to encourage a more careful and profound presentation and discussion of the new ozone climatology. Not everything improves with the new dataset.

- Conclusions: Are there any plans to extend the climatology to the most recent years (2009-2013)? Is the trajectory-based ozone dataset publicly available?

Technical corrections:

- P 18640, l 25: Northern

- P 16849, l 13: 30°N and 70°N

- Fig. 1: People with red-green blindness might have problems to distinguish the red and green dots.

- Fig. 10, lower right panel: (g) -> (h)

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